The Effect of Implementing a Care Bundle on Prevention of Thirst Intense and Mouth Dryness among Postoperative Oncology Patients in Intensive Care Unit

Sara Abo Baker Mohamed AlNoah1, Asmaa Ibrahim AboSeada 2, Nahed Attia Kandeel 3

1Quality Coordinator, Damietta Cancer Institute, Faculty of Nursing Mansoura University. Email: sarasra082@gmail.com

2Assist Professor of Critical Care and Emergency Nursing, Faculty of Nursing,

Mansoura University. Email: hyn-asmaaa@ yahoo.com

3Professor of Critical Care and Emergency Nursing, Faculty of

 Nursing, Mansoura University. Email.Nahed_Kandeel@mans.edu.eg

1.ABSTRACT

Background: Thirst is an unpleasant sensation that occurs most frequently in the postoperative period. Patien[..] undergoing surgery and cancer treatment, in particular, are thirstier than normal patients. Thirst care bundle is a new tre[..] used to minimize intense thirst and mouth dryness. **Aim:** This study aimed to investigate the effect of implementing a ca[..] bundle on prevention of thirst intense and mouth dryness among postoperative oncology patients in the intensive care u[..] (ICU). **Method:** A quasi-experimental research design was used with a purposive sample of 102 adult postoperati[..] oncology patients admitted to the surgical ICU of the Damietta Cancer Institute. The eligible patients were assign[..] randomly into two groups: the intervention group (patients who received the thirst care bundle) and the control gro[..] (patients who received routine care). Data were collected using two tools: a thirst intensity assessment sheet and or[..] condition assessment checklist. **Results:** The study findings revealed that the total average thirst and total oral conditi[..] scores were statistically significantly lower in the intervention group compared to the control group. **Conclusio[..]** Implementing the thirst bundle is an effective technique to prevent postoperative oncology patients' thirst and mou[..] dryness. **Recommendations:** In ICU, the thirst bundle should be adopted as part of the daily care for oncology patier[..] postoperatively.

Keywords: *Mouth Dryness, Post-Operative Oncology Patients, Thirst care bundle, Thirst Intensit*y

2.Introduction

Cancer is one of the most important causes of death worldwide, and it is also responsible for 9.9 million deaths in 2020 **(Sung et al., 2021)**. Cancer patients who receive chemotherapy or bone marrow transplantation are suffering from a weakened immune system, so they are susceptible to infection easily **(Cordonnier et al., 2021)**. They sometimes need admission to the intensive care unit (ICU) post operation for close observation **(Naar et al., 2022)**. The postoperative phase is a complex process that lasts for a while, during which oncology patients feel unwell, anxious, and in pain due to invasive lines and tubes, and oral stomatitis **(Guner, Akin, & Durna, 2014)**. Hence, continues assessment and care must be given to cancer patients to prevent dry mouth and thirst **(Shimosato, Asai, Yokomichi, Nagano, & Sakane, 2021).**

Many stressor factors are facing postoperative oncology patients, including pain, insomnia, and a lack of privacy **(Mollaoğlu, Karabulut, Boy, Mollaoğlu, & Karadayı, 2022)**. Dryness of the patient mouth and thirst are the most neglected stressors during nursing care in ICU **(Shikha, Vinay, & Neetu, 2020; Zhang, Gu, Gu, Zhao, & Zhu, 2022)**. Thirst is thought to be a common, intense, upsetting, and unappreciated symptom in admitting ICU patients **(Puntillo et al., 2010)**.

Between 75% and 89.6% of an adult patients experience postoperative thirst, which is a serious discomfort **(Nascimento et al., 2020)**. Over 70% of oncology patients reported unsatisfied thirst **(Puntillo et al., 2010)**. A study conducted by **Nascimento et al. (2019)** reported that 78% of the patients experienced thirst during the immediate postoperative period. Another study reported that 89.6% of participants reported a thirst sensation with the largest portion being gynecological and

obstetric patients (**Pierotti, Fracarolli, Fonseca, and Aroni, 2018**).

There are multidimensional factors affecting thirst in ICU patients, such as high blood glucose, surgery, and severity of illness (**Lin, Li, Chen, & He, 2023**). Moreover, the prolonged preoperative fasting and fluid imbalance experienced by surgical patients in particular make them even more thirsty (**M Oztas, & Oztas, 2022;Nascimento et al.,2019**). Patients often report their desire to drink fluids while they are in the ICU, but nurses frequently fail to document it, causing patients to experience greater distress and discomfort due to the intensity of their thirst (**Nascimento et al., 2019**).

Despite these factors that affect patient thirst and increase discomfort, the patients do not verbalize their sensation of thirst (**Nascimento et al., 2020**). This could be due to the anesthetic medications, loss of consciousness, and the presence of nausea and vomiting (**Nascimento, Fonseca, Rosseto, & Santos, 2014**). Additionally, there is no standardized policy or regulation to assess mouth dryness and thirst intensity during the postoperative period (**Seada, Younis, & Eid, 2020**). Hence, a significant problem and critical concern for health care workers is identifying simple and safe methods to reduce thirst among patients following surgery (**Nascimento et al., 2014**). The evidence-based recommendations call for standardized reporting and assessment of thirst and mouth dryness among oncology patients (**Ho, Goh, Tang, & See, 2021**; **Nakajima, 2017**).

Xerostomia is the subjective symptom of dry mouth (**Hopcraft & Tan, 2010**). It typically happens as a result of the side effects of chemotherapy (**Gibson, Periyakaruppiah, Thornhill, Baker, & Robinson, 2020**), and oxygen therapy following extubation (**Sato, Tsuda, Odawara, Kushida, & Taniguchi, 2022**). During xerostomia, there is a lack of salivary flow which increases the risk of oral problems and the growth of pathogenic microorganisms in the oral cavity (**Liotti et al., 2019**).

Saliva has antibiotic properties and acts as a buffer action in which protecting mucousa, tooth remineralization, digestive effects, and cleaning effect, according to a recent study by **Kawanishi, Hoshi, Adachi, Ichigaya, and Kimoto, (2021)**. Thirst care bundle is a new trend used to minimize thirst intense and mouth dryness among ICU patients (**Puntillo, Arai, Cooper, Stotts, & Nelson, 2014**). It consists of ice water spray, oral swab wipes, and menthol lip moisturizer (**Puntillo et al., 2014; VonStein et al., 2019**).

Through empirical observation, we noted that the members of the health team are not fully aware of the thirst care bundle to deal with thirst and dry mouth. Additionally, we noted that these common symptoms do not receive adequate nursing care at the surgical ICU. They are highly neglected, undervalued, and unnoticed by the critical care nurses as the main focus is on patients' hemodynamic stability.

The study conducted by **Nakajima (2017)** reported a high incidence of oral problems (64.8%), including dry mouth, stomatitis, and oral candidiasis, among terminally ill oncology patients with poor oral intake. The health care providers are worried about the rising incidence of candidiasis tropicalis in clinical isolation among cancer patients (**Jahanshiri, Manifar, & Hatami, 2023**).

Furthermore, Ho et al. (2021) reported that a lack of health care team communication with the patient, as well as a lack of awareness about the significance of oral assessment and care, caused the patient to feel thirsty. **Sebaee and Elhadary (2017)**, observed that nursing staff were not adequately trained to cope with thirst during the pre- and postoperative periods and allowed their patients to remain thirsty for a prolonged period. However, there is little evidence regarding the effectiveness of implementing the care bundle on the prevention of intense thirst and mouth dryness among oncology patients in Egypt. Therefore, more attention should be given to postoperative thirst. Therefore, this study was done to investigate the effect of implementing a care bundle on prevention of thirst intense and mouth dryness among postoperative oncology patients.

2.1Aim of study

The aim of this study was to investigate the effect of implementing a care bundle on prevention of thirst intense and mouth dryness among postoperative oncology patients in ICU.

2.2Research hypothesis

To fulfill the aim of this study, we hypothesized that the implementation of a care bundle will reduce thirst intense and mouth dryness among postoperative oncology patients compared to the control group who will receive the routine care.

2.3Operational definition;

Care bundle is a new trend used to prevent thirst intense and dry mouth. Care bundle consists of three components: oral swab wipes, menthol moisturizer and sterile ice-cold water sprays applied to the patient's lips (**Puntillo et al., 2014**).

3. Method

3.1 Design

A quasi-experimental research design was used to conduct this study. This design is used to investigate the effectiveness of an intervention without randomization **(Polit & Beck, 2018)**.

3.2 Setting

This study was conducted in the postoperative surgical ICU of Damietta Cancer Institute. This unit includes 6 beds. The ratio of nurse to patient in the selected surgical ICU is approximately 1:2. The surgical ICU is well-stocked with the most recent medical supplies, tools, and equipment needed for patient care. It provides services for patients who have undergone major surgical operations such as hysterectomy, splenectomy, cholecystectomy, oophorectomy, nephrectomy, colostomy, total thyroidectomy, bilateral mastectomy, and colon and rectum surgery. This ICU receives patients from the operating rooms during 4 days/week; Saturday, Sunday, Tuesday and Wednesday. The unit receives about 20-30 patients monthly.

3.3 Sample/Participants

A purposive sample of 102 adult postoperative oncology patients who were hospitalized in the aforementioned surgical ICU included in this study. The eligibility criteria included fully conscious, postoperative patients, ages 20 to 80, of both genders, who underwent abdominal surgery and were willing to participate in the study. The exclusion criteria included patients who had undergone surgical procedures in the mouth, were mechanically ventilated, or had open sores or desquamation on the mouth or lips.

3.4 Data Collection Tools

Data for the study were collected using two tools:

Tool I: Thirst Intense Assessment Sheet

This tool consists of two parts:

Part I: Participants' Demographic Characteristics and Health Relevant Data

This part was developed by the primary investigator (PI) after reviewing relevant literature **(Gul, Andsoy & Ozkaya, 2018; Kim et al., 2012; Puntillo et al., 2014)**. This part aimed to collect participants' demographic characteristics and health relevant data that affect thirst intense and dry mouth. It included information about patient's name, age, gender, diagnosis, type of operation, date of surgery and pre-operative fasting time. It also involved date related to the type of anesthesia, duration of surgery, amount of blood lost during surgery, post-operative fasting time, opioid use and recent chemotherapy or radiation.

Part II: Thirst Intensity Scale

This part was adopted from **Yang, Yates, Chin and Kao (2010)**. It assessed the severity, strength, or amount of thirst. A visual analogue scale (VAS) was used to measure thirst intensity among postoperative oncology patients. In addition, it includes the presence or absence of thirst (yes/No). Patients were requested to rate their thirst intensity on a 10-cm VAS, with 0 indicating no thirst at all, and 10 indicating the worst possible thirst. The VAS score was classified as follows: mild (1-3), moderate (4-6) and severe (7-10). According to the study of Kara, (2013), this scale is valid and reliable. The Cronbach's alpha coefficient was 0.81.

Tool II: Oral Condition Assessment Checklist

This tool was adopted from **Al Sebaee and Elhadary (2017)**. This is a modified form of oral health assessment tool that was originally developed by Korean Institute in 2012. The aim of this tool is to measure changes of oral condition as regards lips, tongue, mucosa. and saliva for postoperative oncology patients The scoring system for this tool was as follows :"Healthy =1 score", "Moderate oral health problem =2 scores" and "Severe health problem = 3 scores".

3.5 Validity and Reliability

A panel of five experts from the Critical Care and Emergency Nursing Department of the Faculty of Nursing at Mansoura University evaluated the content validity of data collection instruments. They examined the tool for precision, usefulness, and applicability. They suggested various changes to part 1 of tool I, like the addition of variables like pre-operative fasting time, post-operative fasting time, and amount of blood lost during surgery that can alter thirst intensity. The overall reliability of tools was tested using a special case of Cronbach's alpha, which assesses the internal consistency of the tools. The dependability of data gathering tools was also examined. The reliability of parts 2 of tools I and II were 0.960 and 0. 939, respectively, indicating high reliability.

3.6 Pilot Study

Ten patients (10% of the sample size) participated in pilot research to evaluate the clarity, feasibility and the applicability of the data collection tools. . This group was excluded from the main study. Additionally, the pilot study gave the PI the experience needed for dealing with the study participants, familiarity with study the

setting, and estimating the time needed to complete the data collection sheets.

3.7 Ethical Considerations

Ethical approval was granted from the Research Ethical Committee of the Faculty of Nursing, Mansoura University. An official approval was obtained from Damietta Cancer Institute administration board after explaining the aim and nature of the study. All surgical intensive care nurses and physicians were informed about the study prior to initiating data collection. The purpose, procedure, advantages, and risks of the study were explained to eligible patients. They were assured that taking part in the study was completely up to them and that doing so would not have any negative consequences. They received assurance of the privacy of their personal information as well.

3.8 Data Collection Process

Between June 2020 and February 2021, data were gathered in three stages, including preparation, implementation, and evaluation.

Preparation phase

- This phase lasted from June 2020 to August 2020. The director of the hospital granted official permission for the study to be carried out.
- The tools were adopted based on recent relevant literature.
- Thirst intensity scale was translated into Arabic version by an expert translator.
- Then back translation technique was used to ensure the validity of translation.
- The reliability of part 2 of tool I and tool II was tested by using Cronbach's alpha test.

Implementation phase

Stage one: Initial assessment

- Data were collected between August 2020 and February 2021.
- Patients who were admitted to the study setting were screened for inclusion and exclusion criteria.
- Eligible patients were assigned randomly into two groups: the intervention group (patients who received the care bundle) and the control group (patients who received the routine care). The allocation of the patients was done by using a lottery randomization technique through choosing one of two cards labeled group A (intervention group) and group B (control group).

- Each group involved 51 patients.
- Patients in both groups were assessed by the PI and demographic characteristics and health-related data were coded using part 1 of tool I.
- Patients in both groups were assessed for the degree of thirst using part 2 of tool I.
- Patients in both groups were assessed for oral condition before the implementation of care bundle using tool II.

Stage two:

For the intervention group

- All items used in thirst bundle were prepared under an aseptic technique (biological safety cabinet class II type B2) by a professional pharmacist in the clinical pharmacy of Damietta Cancer Institute for each patient.
- All items used in thirst bundle were labeled with patient's name, hospital number and bundle content.
- The thirst bundle was adopted from Puntillo et al., (2014). It was implemented three times per day for two consecutive days in the beginning of each shift for 15 minutes for each session. Patients in the intervention group received the thirst bundle which involved of three components:

A) Oral swab wipe: It was used for cleaning patient mouth after getting wet with sterile ice-cold water.

B) Sterile ice-cold water sprays: It was applied to the patient's lips in order to stimulate sensory cold receptors in the mouth to help in relieving of thirst.

C) Menthol moisturizer: It was used as finger lips and applied to the patient's lips in order to stimulate sensory cold receptors and lubricate the patient's lips.

- Each session lasted about 15 minutes.
- All items used in thirst bundle were a single use for each patient.

For the control group

Patients received the routine mouth care which included applying oral care with wetted gauze with water for two consecutive days.

Evaluation phase

- The two groups were assessed for thirst intense and oral condition using part 2 of tool I and tool II after the implementation of the thirst bundle for two consecutive days.

- The thirst intense and oral condition were assessed and compared between the two groups.

3.9 Data analysis

Using the Statistical Package for Social Science version 25 to code, compute, and statistically analyze the given data (SPSS). Frequencies (n) and percentages (%) were used to express qualitative data. When comparing column proportions, the Chi-Square test or fisher's exact test was applied, with the Bonferroni technique to correct the p values. The frequency, percentages, mean, and standard deviation (SD) of the data were reported (quantitative continuous variables). A significant level value was considered when the p-value ≤ 0.05 and a highly significant level value was considered when the p-value ≤ 0.001.

4. Results

Table 1 presents the demographic characteristics of the studied groups. The results showed that 70.6% of the intervention group and 56.9% of the control group were females. The biggest proportion of the intervention and control groups (41.2% and 43.1%) respectively were in the age group between 51-60 years old. No statistically significant differences were noted between the two groups concerning their gender or age.

Table 1: *Demographic Characteristics of the Studied Groups*

Variables	(n=102)				Significance Test	
	Intervention Group n= 51		Control Group n= 51			
	n	%	N	%	X^2	*p-value*
• Gender:						
Male	15	29.4	22	43.1	2.078	0.149
Female	36	70.6	29	56.9		
• Age:						
20-30	0	0.0	3	5.9		
31-40	2	3.9	7	13.7		
41-50	12	23.5	9	17.7		
51-60	21	41.2	22	43.1	7.614	0.107
61-80	16	31.4	10	19.6		
$\bar{X} \pm SD$	4.00 ± 0.84		3.56 ± 1.13			

Data are expressed as numbers (n), frequency (%), x̄ ± SD: mean Standard Deviation (The chi-square test for independence) X2: Pearson Chi-square, *p-value ≤ 0.050 (significant)*

Table 2 illustrates the health-relevant data of the studied groups. No statistically significant differences were noted between the two groups concerning the common medical diagnosis, type of surgery, duration of surgery, pre and postoperative fasting time, post operation opioid use, and recent preoperational chemotherapy or radiation. However, statistically significant differences were noted between the two groups regarding the type of anesthesia (p=0.046) and the amount of blood loss (p=0.017). The biggest proportion had the diagnosis of genital and urinary cancer (41.2 %) in each group. Therefore, 49.1% of the intervention group and 56.8% of the control group had undergone genital surgery. The majority of patients in the two groups received general anesthesia (84.3% and 96.1% respectively). Additionally, 66.7% of the intervention group and 76.5% of the control group lost about 500cc of the blood during surgery. The post-operative fasting was 24 hours for most patients in the two groups (64.7% and 70.6% respectively). The majority of patients in the two groups did not receive preoperative chemotherapy or radiotherapy (86.6% and 72.5% respectively).

Table 2 *Health-Relevant Data of the Studied Groups*

Variables	(n=102)				Significance Test	
	Intervention Group		**Control Group**			
	(*n*= 51)		(*n*= 51)			
	n	%	N	%	X^2	*p-value*
Diagnosis						
Genital & Urinary Cancer	21	41.2%	21	41.2%	-	0.762
Liver & Pancreatic	3	5.9%	3	5.9%		
Colorectal Cancer	17	33.**3** %	11	21.6 %		
Upper GI Cancer	3	5.9%	5	9.8%		
Pelvic Cancer	-	-	2	3.9%		
Renal cell carcinoma	3	5.9%	5	9.8%		
Other	4	7.8 %	4	7.8%		
Type of surgery:						
Abdominal Exploration	10	19.6 %	7	13.8%	-	0.952
Liver & Pancreatic surgery	2	3.9%	3	5.9%		
Colorectal surgery	8	15.7%	7	13.8 %		
Genital surgery	25	49.1%	29	56.8 %		
Gastrointestinal surgery	5	9.8%	4	7.8 %		
Splenectomy	1	1.9%	1	19.%		

Data are expressed as numbers (*n*), frequency (%),(The chi-square test for independence) X2: Pearson Chi-square, *p-value ≤ 0.050 (significant*)

Cont. Table 2 *Health-Relevant Data of the Studied Groups*

Variables	(n=102)				Significance Test	
	Intervention Group		**ntrol Group**			
	(*n*= 51)		(*n*= 51)			
	n	%	N	%	X^2	*p-value*
Pre-operative fasting time:						
• 12hrs	49	96.1	51	100	2.040	0.153
• More than 12hrs	2	3.9				
Type of anesthesia:						
• General anesthesia	43	84.3	49	96.1	3.991	**0.046**
• Epidural blockage & General anesthesia	8	15.7	2	3.9		
Duration of surgery:						
• 1-2 hrs.	23	45.1	28	54.9	0.980	0.322
• 2-4 hrs.	28	54.9	23	45.1		
Amount of blood loss:						
• None loss	3	5.8	8	15.7	8.171	**0.017**
• 500 cc	34	66.7	39	76.5		
• 1000cc or more	14	27.5	4	7.8		
Post operation opioid use:						
• Yes	51	100	51	100		
Post-operative fasting time:						
• 8 hrs.	1	1.9	4	7.8	2.711	0.438

	12 hrs.	7	13.7	4	7.8		
	24 hrs.	33	64.7	36	70.6		
	More than 24 hrs.	10	19.7	7	13.8		
Recent preoperational chemotherapy or radiation:							
	Yes	16	32.4	14	27.5	0.250	0.617
	No	35	86.6	37	72.5		

Data are expressed as numbers (***n***), frequency (%), (The chi-square test for independence) X2: Pearson Chi-square, ***p-value ≤ 0.050 (significant).***

Table 3 compares average of thirst between the two groups three times per day for two consecutive days before and after the implementation of the thirst bundle of care. Thirst average decreased after the implementation of the bundle of care in in the three sessions of day1 in the intervention group (p1 =0.000 for all). However, no significant differences were noted in the control group after the routine care (p1 =0.157, 0.157, 0.083, respectively).

In day 2, a significant difference was also noted in the intervention group after the implementation of the thirst bundle of care in the three measured times (p1 =0.000 for all). However, in the control group, only a significant difference was noted in time1 of day 2 (p1 =0.004). Significant differences were detected between the two groups in the three measured times during the two consecutive days of the study (p2=0.002, <0.001, <0.001, <0.001, <0.001, <0.001, respectively).

Table 3 *Comparing the Average of Thirst Before and After Implementation of Thirst Bundle Sessions for Two Consecutive Days Between the Studied Groups*

Day		Time		Intervention Group (n= 51)			Control Group (n= 51)			Significance Test—	
				Average of Thirst			**Average of Thirst**			**Wald** χ^2	**P2**
				Min	Median	Max	Min	Median	Max		
Day1	Day1	Time1	before	3	3.00	3	3	3.00	3	9.246	**0.002**
		Time1	after	2	2.00	3	2	3.00	3		
		Significance test Z p1			6.633 **0.000**			1.414 0.157			
		Time2	Before	2	3.00	3	2	3.00	3	33.288	**<0.001**
		Time2	After	1	2.00	3	2	3.00	3		
		Significance test Z p1			6.633 **0.000**			1.1414 0.157			
		Time3	Before	2	2.00	3	2	3.00	3	45.386	**<0.001**
		Time3	After	1	2.00	2	2	3.00	3		
		Significance test Z p1			4.811 **0.000**			1.732 0.083			
Day2	Day2	Time1	Before	2	3.00	3	2	3.00	3	27.792	**<0.001**
		Time1	After	1	2.00	2	2	2.00	3		
		Significance test Z p1			6.593 **0.000**			2.887 **0.004**			
		Time2	Before	1	2.00	2	1	2.00	3	47.465	**<0.001**
		Time2	After	1	1.00	2	1	2.00	3		
		Significance test Z p1			5.745 **0.000**			1.000 0.317			
		Time3	Before	0	1.00	2	0	2.00	3	46.162	**<0.001**
		Time3	After	0	0.00	2	0	2.00	3		
		Significance test Z p1			6.325 **0.000**			1.732 0.083			

Data are expressed as Z: wilcoxon signed ranks, test, *p-value ≤ 0.050 (significant)*, P1: significant difference in each group, P2:value significant difference between studied groups over the two time points using generalized estimating equations (GEE), The VAS scores classified as none (0,coded 0) mild (1-3, coded1) moderate (4-6,coded2) and severe (7-10,coded3).

Table 4 compares the total oral condition score post implementation of the bundle adjusted for pre implementation of the bundle between the two groups. It showed that the mean of total oral condition score pre and post the routine care in the control group was 1.58 and 1.48, respectively (adjusted post-intervention mean of total oral condition score was 1.41). The mean pre and post intervention of total oral condition score in the intervention group was 1.41 and 1.06, respectively (adjusted post-intervention mean of total oral condition score was 1.13). One-way ANCOVA revealed that the adjusted post-intervention of the total oral condition score was statistically significantly lower in the intervention group compared to the control group with a large effect size which reflects the effectiveness of the thirst bundle in enhancing the oral condition.

Table 4 *Comparing the Total Oral Condition Score Post Implementation Adjusted for Pre-Implementation of the Thirst Bundle as a Covariate Between the Two Groups*

Total Oral Condition Score	Control Group (*n*= 51)	Intervention Group (*n*= 51)	F	p-value	Partial η²
Unadjusted mean ± SD Pre-intervention Post-intervention	1.58 ± 0.18 1.48 ± 0.22	1.41 ± 0.15 1.06 ± 0.10	179.032	**<0.001**	0.644
Adjusted mean ± SE Post-intervention	1.41 ± 0.014	1.13 ± 0.014			

Data are expressed as SD = standard deviation. SE standard error. Partial □2 is a measure of effect size (Partial □2 of 0.644 = an effect size Cohen's f of 1.344987 (large). The test of significance is one-way ANCOVA.

Table 5 presents the correlation between the studied groups regarding thirst intensity and oral condition before and after implementation of the thirst bundle. The results showed a strong positive correlation between the total of oral condition and the total average of thirst intensity before and after the implementation of the thirst bundle in the intervention group (P = 0.000 & 0.001 respectively) and in the control group (P = 0.024 & 0.000 respectively) throughout the three sessions during the two consecutive days of the study. It means that when the thirst intensity decreases, the oral condition will be improved and when the thirst intensity increases, the oral condition deteriorated. This correlation supports the research hypothesis that the implementation of the thirst bundle reduces thirst intensity and mouth dryness among the intervention group.

Table 5 *Correlation Between the Thirst Intensity and Oral Condition Before and After Implementation of Thirst Bundle in the Studied Groups*

Variables	Intervention Group (*n*= 51)		Control Group (*n*= 51)	
	Total Average of Thirst Intensity		Total Average of Thirst Intensity	
	Before	**After**	**Before**	**After**
Total Oral Condition				
R	0.672**	0.465**	0.316**	0.572**
P	0.000	0.001	0.024	0.000

Data are expressed as Data are expressed as r: **Spearman's correlation, P: significant value and as numbers (n), *p-value ≤ 0.050* (significant)

5.Discussion

The most stressful conditions that typically affect ICU patient are increased thirst and dry mouth. Patients undergoing surgery and cancer treatment, in particular, are thirstier than normal patients. Effective oral care reduces oral health issues and alleviates thirst and dry mouth in ICU patients, both of which have an adverse influence on the patient's wellbeing **(Sebaee & Elhadary, 2017)**. The current evidence of "thirst care bundles" is used to stop dry mouth and extreme thirst. It is straightforward, affordable, safe, and simple for nurses or patients to utilize **(Puntillo et al., 2014)**. Hence, the present study aimed to investigate the effect of implementing a care bundle on prevention of thirst intense and mouth dryness among postoperative oncology patients.

The findings of the current study illustrated that two-thirds of the intervention bundle patients were females. This is because the main type of surgery is genital surgery (hysterectomy and oophorectomy). In the developed countries, hysterectomy is performed by about 600,000 women in the United States, and 40,000 in England annually **(Rahman, Gupta, & Manyonda, 2017)**. While in Egypt, there are 165,107 hysterectomy procedures performed each year **(Health grade, 2016)**. **The Global Cancer Observatory (GCO), (2020)** pointed out that the number of new cancer cases per year in Egypt in 2020 were around 2787, 1694, 1320, and 3430 cases for ovary, uterine, cervix, and colon respectively **(Sung et al., 2021)**.

This finding is in agreement with **Serato et al. (2019)** who revealed that females were the predominant in the studied patient sample. On the other hand, a study by **Seada et al. (2020)** who assessed the impact of a frozen saline swab on mouth dryness and thirst intensity in critically ill post-operative Egyptian patients found that more than two-thirds of the control group were males compared to about two thirds in the study group. These differences could be a result of the different studies' inclusion criteria.

The present study revealed that most of the intervention group and the control group were in the age group of 51 - 60 years old. According to the **National Cancer Institute (2021)**, the most significant risk factor for cancer generally and for many specific cancer types is advancing age. Incidence rates for cancer rise consistently with age, from less than 25 cases per 100,000 in the under-20 age group to roughly 350 per 100,000 in the 45–49 age group to more than 1,000 per 100,000 in 60 years and older. There is a study conducted in Egypt about the incidence rate of uterine cancer, found that uterine cancer increased significantly with increasing age and the majority of patients (83%) were postmenopausal **(Alshahrani et a l., 2018)**.

Aging linked to immune system alterations is associated with a number of pathogenic processes that underlie the growth of cancer **(Hong et al., 2019)**. In the same line with our results **Flim, Hofhuis, Spronk and Jaarsma, (2022)** measured the patients' level of thirst intense in the ICU. They found that participants were between 57-74 years old.

However, **Elmashad and Gouda (2018)** evaluated the effectiveness of frozen saline in postoperative patients in relieving their thirst and reported that about half of cases aged from 40-49 years old. These differences could be attributed to the study's inclusion criteria, which evaluated postoperative gynecological patients.

As regards the patients' medical diagnosis, the most frequent reasons for admission in the current study for both investigated groups were colon and genital urinary cancer, with no statistically significant difference between them. In Egypt, cancer colon has an unusual epidemiologic profile and survival pattern **(Metwally et al., 2018)**. According to Egypt's National Cancer Registry Program, female genitourinary malignancies rank fourth among all cancers **(Ibrahim, Khaled, Mikhail, Baraka, & Kamel, 2014)**. Damietta Cancer Institute is considered one of the participants in this program.

Regarding the type of surgery, the current results depicted that genital and colon surgeries are the main types of surgeries in the current study. This could be because most of the patients were females. In harmony with the previous findings, **Nascimento et al. (2019)** studied the prevalence, intensity, and discomfort of thirst in surgical patients in the immediate post-operative period. They revealed that the most frequent surgeries were gynecological and obstetric. Conversely, **Sebaee and Elhadary (2017)** reported that nearly half of participants in both groups had hernia repair surgeries.

The vast majority of intervention group and all patients in the control group had a 12-hour fasting period pre-operatively. This is a common protocol in the Egyptian hospitals prior to elective

operation to lessen anesthesia-related complications and unfavorable effects on the digestive and respiratory systems. Fasting for 12 hours is considered a long time for preoperative period and increases patients' sensation of starvation after mid night, mouth dryness, and thirsty (**Bayramoğlu, & Akyüz, 2021**).

According to the study conducted by **Campos et al. (2018)** who investigated the effect of abbreviation preoperative fasting on the surgical patient. This study estimated that mid night fasting considered as a mal practice which increases the catabolic hormones such as cortisol and glucagon, inflammatory response and catecholamine secretion and not seem as best point for the surgical patient. Additionally, the two hours fasting before their elective surgery is the most benefit for the surgical patients. However, the traditional method for preoperative fasting still used in the study's setting.

These findings are in agreement with the results of the study conducted by **Gul et al. (2018)** who investigated the relation between traditional proper fasting and patient discomfort in surgical patients. This study estimated that the mean preoperative fasting times were 13.34 ± 3.07 hours for solids and 12.44 ± 2.82 hours for fluids. The current study finding is also congruent with **Virgens et al. (2020)** study. On the other hand, **Tereza et al. (2021)** applied the protocol for thirst management using ice popsicles in the immediate postoperative period. They found that the fasting time of the patients showed a median of 9 hours and 50 minutes (minimum 2 hours and maximum 16 hours).

Regarding the type of anesthesia, the majority of the studied groups had operation procedure under general anesthesia with statistically significant differences between the two groups. These findings are in agreement with **Lee et al. (2020)** who studied the prevalence, risk factors, and optimized management of moderate-to-severe thirst in the post-anesthesia care unit. The study reported that all patients received general anesthesia. This similarity may be due the nature of surgeries.

The present study revealed that two thirds of the intervention group three-quarters of the control group had a blood loss of about 500cc during surgery with statistically significant difference between both groups. Blood loss increases the sensation of thirst postoperatively, because there is a loss of electrolytes, which is closely related to the amount of water present in the body (**Watson & Austin, 2021**).

The present findings depicted that all patients in both groups received post operation opioids. Supporting our findings, **Serato et al. (2019)** study examined the effect of package of menthol measures for thirst relief. They found that the highest percentage of patients received opioids and anticholinergics during the anesthetic-surgical procedure. This is because both studies involved postoperative patients who need opioids to control pain after surgery.

Concerning the postoperative fasting time, the present study showed that nearly two-thirds of the intervention group and nearly three-quarters of the control group had a-24 hours postoperative fasting. The study setting used the traditional method for postoperative oral nutrition that was initiated after the return of bowel function, the passage of flatus, the passage of stool and bowel sounds. This traditional method has been used to prevent postoperative complications and reduce the incidence of paralytic ileus or anastomotic leakage (**Yamada et al., 2012**).

The ESPEN guideline for clinical nutrition in surgery (2017) advised starting oral intake with clear liquids in the hours following surgery for the majority of patients and early enteral feeding with clear liquids on the first or second postoperative day for the colon or rectum surgery patients. Early feeding does not cause impairment of healing and enhances patients' recovery (**Weimann et al., 2017**).

The present study showed that the vast majority of the intervention group and control group did not receive chemotherapy or radiation before surgery with no statistically significant differences noted between both groups. This is because surgery remains the cornerstone of cancer treatment. The main goal of surgery is to treat cancer to completely remove the tumor or cancerous tissue from a specific place in the body for non-hematological cancers (**Wang, Lei, & Han, 2018**).

The present study revealed that there was a decrease in the intensity of thirst from severe to mild degree along the time of study after implementing the thirst bundle steps with significant differences noted among patients in the intervention group along the time of study. This is due to the fact that patients in the intervention group received a package of measures to guarantee the highest quality of treatment, but the control group only received standard hospital care, which may suggest a lack of guidelines.

Recent discoveries in sensory physiology explain this improvement in the sensation of thirst as both cold temperatures and menthol products stimulate the sensory nerve endings, by triggering the activation and generation of action potentials, and nerve impulse which are more effective to relieve thirst in postoperative patients (**Serato et al., 2019**).

This agrees with a study conducted by **Tsai, Chao and Hsiao (2022)** which reported the effectiveness of cold oral stimuli using ice cubs, or ice chips in decreasing postoperative thirst. An Egyptian study conducted by **Ahmad (2019)** compared the effects of utilizing cold water oral swabs, and cold saline oral swabs to reduce thirst intensity and oral health. The study reported a decreased intensity of thirst all over the three times of using wet swap with cold saline during pre and post procedure with significant differences.

Additionally, **Sebaee and Elhadary (2017)** study about a care bundle by using ice-cold normal saline with menthol postoperatively, found a significant decrease in thirst intensity among immediate postoperative patients who had undergone abdominal surgeries. Also, a decrease in thirst intensity of the intervention group with a highly significant statistical difference between both groups was noted in their study. On the other hand, **Serato et al. (2019)** who investigated the effect of menthol packages in thirst relief among surgical patients, reported that there was a high incidence of thirst intensity during the postoperative period as in bariatric surgery (97.6%).

The current findings depicted that all patients reported severe thirst in the first time of our study. This was in disagreement with **Doi, Nakanishi, Kawahara, and Nakayama, (2021)** who studied the impact of oral care on thirst perception and dry mouth assessments in intensive care patients. They reported that only 20% of patients in the ICU complained of thirst independently in this study. These differences may be explained by the different inclusion criteria used in each study, as the current study focused on postoperative patients however, the other study assessed all patients in the ICU.

Regarding the oral condition, the current findings showed improvement in the oral condition after the implementation of the thirst bundle for two consecutive days. This may be due to that all items of the bundle were prepared under an aseptic technique and all steps were implemented three times per day, which protected the mouth from dryness, and improved the oral condition of the

patients. Also, there was a combination of oral swab wipes after getting wet with sterile ice-cold water and sterile ice-cold water sprays with menthol moisturizer, which allowed complete hydration to the oral cavity (**Puntillo et al., 2014; VonStein et al., 2019**).

The current findings illustrated a strong positive correlation between the oral condition and the thirst intensity before and after intervention among both groups. In the same line with our findings, **Seada et al. (2020)** who found a strong positive correlation between the oral condition and the thirst intensity before and after intervention in the two studied groups.

6. Limitations

This study involved a small size sample from one oncology hospital in one geographical area in Egypt that restricts the generalization of the study findings.

7. Conclusion and recommendations

Using thirst care bundle as a part of the daily care in managing patients' complaints of thirst in postoperative oncology patients in ICU. Continuous training sessions and set new policies about new recommendations of per and postoperative fasting and early postsurgical feeding time based on the new evidence instead of the traditional method. Additionally organizing continuous in-service training and refresher sessions for critical care nurses about new modalities and bundles of care for the management thirst intense and mouth dryness.

8. Acknowledgments

We would like to say thank you to all oncology patients who consent to participate in this study.

9. Declaration of Conflicting Interests

No potential conflicts of interest were disclosed by the authors with respect to the study or publication of the article.

10. References

Ahmad, I. M. (2019). Comparison between effect of using cold water oral swab and cold saline oral swab to relieve thirst intensity and oral condition of mechanically ventilated patient. *American J Nurs Res*, *7*, 8-13. DOI:10.12691/ajnr-7-1-2

Alshahrani, S., Soliman, A. S., Hablas, A., Ramadan, M., Meza, J. L., Remmenga, S., ... & Chamberlain, R. M. (2018). Changes in uterine cancer incidence rates in Egypt. *Obstetrics and gynecology international*,

2018. Retrieved from https://doi.org/10.1155/2018/3632067

Bayramoğlu, B. G., & Akyüz, N. (2021). Investigation of preoperative fasting time and preoperative and postoperative well-being of patients. *Florence Nightingale Journal of Nursing, 30*(1), 33. Retrieved from https://doi.org/10.5152%2FFNJN.2022.21047

Campos, S. B. G., Barros-Neto, J. A., Guedes, G. D. S., & Moura, F. A. (2018). Pre-operative fasting: Why abbreviate? *ABCD. Arquivos Brasileiros de Cirurgia Digestiva (São Paulo), 31.* Retrieved from https://doi.org/10.1590/0102-672020180001e1377

Cordonnier, C., Ljungman, P., Cesaro, S., Hirsch, H. H., Maschmeyer, G., von Lilienfeld-Toal, M., ... & Maertens, J. (2021). The EHA research roadmap: Infections in hematology. *HemaSphere, 5*(12). DOI:10.1097/HS9.000000000000662

Doi, S., Nakanishi, N., Kawahara, Y., & Nakayama, S. (2021). Impact of oral care on thirst perception and dry mouth assessments in intensive care patients: An observational study. Intensive and Critical Care Nursing, 66, 103073.Doi: 10.1016/j.iccn.2021.103073

Gibson, B., Periyakaruppiah, K., Thornhill, M. H., Baker, S. R., & Robinson, P. G. (2020). Measuring the symptomatic, physical, emotional and social impacts of dry mouth: A qualitative study. *Gerodontology, 37*(2), 132-142. Retrieved from https://doi.org/10.1111/ger.12433

Gul, A., Andsoy, I. I., & Ozkaya, B. (2018). Preoperative fasting and patients' discomfort. *Indian Journal of Surgery*, *80*, 549-553. DOI 10.1007/s12262-017-1657-4

Guner, C. K., Akin, S., & Durna, Z. (2014). Comparison of the symptoms reported by post-operative patients with cancer and nurses' perception of patient symptoms. European *Journal of Cancer Care, 23*(4), 523-530. DOI: 10.1111/ecc.12144

Health grades (2016): Statistics by country for hysterectomy. [Online] Retrieved from: http://www.rightdiagnosis. com/h/hysterectomy/statscountry.htm

, H., Wang, Q., Li, J., Liu, H., Meng, X., & Zhang, H. (2019). Aging, cancer and

immunity. *Journal of Cancer*, *10*(13), 3021. DOI: 10.7150/jca.30723

Hopcraft, M. S., & Tan, C. (2010). Xerostomia: an update for clinicians. *Australian dental journal*, *55*(3), 238-244. DOI: 10.1111/j.1834-7819.2010.01229.x

Ho, V., Goh, G., Tang, X. R., & See, K. C. (2021). Under recognition and undertreatment of thirst among hospitalized patients with restricted oral feeding and drinking. *Scientific Reports*, *11*(1), 1-8. Retrieved from

https://doi.org/10.1038/s41598-021-93048-4

Elmashad, H. A. M., & Gouda, A. M. I. (2018). Effect of frozen saline on postoperative thirst among women undergoing gynecological surgery. *International Journal of Novel Research in Healthcare and Nursing, 5*(3), 180-189 Retrieved from http://www.noveltyjournals.com

Flim, M., Hofhuis, J., Spronk, P., & Jaarsma, T. (2022). Measuring thirst distress of patients in the intensive care unit. *Nursing in Critical Care, 27*(4), 576-582.

Retrieved from
https://doi.org/10.1111/nicc.12719

Ibrahim, A. S., Khaled, H. M., Mikhail, N. N., Baraka, H., & Kamel, H. (2014). Cancer incidence in Egypt: Results of the national population-based cancer registry program. *Journal of Cancer Epidemiology, 2014.* Retrieved from https://doi.org/10.1155/2014/437971

Jahanshiri, Z., Manifar, S., & Hatami, F. (2023). Evaluation of virulence factors and azole resistance mechanisms of Candida tropicalis isolates from head and neck cancer patients with OPC. *Iranian Journal of Microbiology*, *15*(1), 163-173. Retrieved from https://doi.org/10.18502/ijm.v15i1.11933

Kim, M. Y., Doo, M. J., Kang, S. K., Lim, Y. H., Kim, H. M., Kim, M. K., ... & Kang, J. H. (2012). Postoperative PatientsThirst and Oral Status by Three Oral Care Methods. *The Journal of Korean Academic Society of Nursing Education, 18*(3), 403-412. Retrieved from https://doi.org/10.5977/jkasne.2012.18.3.403

Kawanishi, N., Hoshi, N., Adachi, T., Ichigaya, N., & Kimoto, K. (2021). Positive effects of saliva on oral candidiasis: basic research on the analysis of salivary properties. *Journal of*

Clinical Medicine, *10*(4), 812. Retrieved from https://doi.org/10.3390/jcm10040812

Lee, C. W., Liu, S. T., Cheng, Y. J., Chiu, C. T., Hsu, Y. F., & Chao, A. (2020). Prevalence, risk factors, and optimized management of moderate-to-severe thirst in the post-anesthesia care unit. *Scientific Reports*, *10*(1), 1-10. DOI: 10.1038/s41598-020-73235-5

Liotti, F. M., Posteraro, B., Mannu, F., Carta, F., Pantaleo, A., De Angelis, G., & Sanguinetti, M. (2019). Development of a multiplex PCR platform for the rapid detection of bacteria, antibiotic resistance, and Candida in human blood samples. *Frontiers in Cellular and Infection Microbiology*, *9*, 389. Retrieved from https://doi.org/10.3389/fcimb.2019.00389

Lin, R., Li, H., Chen, L., & He, J. (2023). Prevalence of and risk factors for thirst in the intensive care unit: An observational study. *Journal of Clinical Nursing*, *32*(3-4), 465-476. DOI: 10.1111/jocn.16257

Metwally, I. H., Shetiwy, M., Elalfy, A. F., Abouzid, A., Saleh, S. S., & Hamdy, M. (2018). Epidemiology and survival of colon cancer among Egyptians: A retrospective study. *Journal of Coloproctology (Rio de Janeiro)*, *38*, 24-29. Retrieved from https://doi.org/10.1016/j.jcol.2017.09.418

Mollaoğlu, M. C., Karabulut, O., Boy, Y., Mollaoğlu, M., & Karadayı, K. (2022). Environmental stressors perceived by patients in the surgical intensive care unit. *Turkish Journal of Intensive Care*, *20*(4). DOI: 10.4274/tybd.galenos.2021.28290

Naar, L., Maurer, L. R., Dorken Gallastegi, A., El Hechi, M. W., Rao, S. R., Coughlin, C., ... & Lee, J. (2022). Hospital academic status and the volume-outcome association in postoperative patients requiring intensive care: Results of a nationwide analysis of intensive care units in the United States. *Journal of Intensive Care Medicine*, 08850666221094506 DOI: 10.1177/08850666221094506

Nakajima, N. (2017). Characteristics of oral problems and effects of oral care in terminally ill patients with cancer. *American Journal of Hospice and Palliative Medicine*, *34*(5), 430-434. DOI: 10.1177/1049909116633063

Nascimento, L. A. D., Garcia, A. K. A., Conchon, M. F., Aroni, P., Pierotti, I., Martins, P. R., ... & Fonseca, L. F. (2020). Advances in the management of perioperative patients' thirst. *AORN Journal*, *111*(2), 165-179. Retrieved from http://doi.org/10.1002/aorn.12931© AORN, Inc, 2020

Nascimento, L. A., Fonseca, L. F., Rosseto, E. G., & Santos, C. B. (2014). Development of a safety protocol for management thirst in the immediate postoperative period. *Rev Esc Enferm USP;* *48*(5):831-40 Retrieved from https://doi.org/10.1590/S0080-6234201400005000009

Nascimento, L. D., Nakaya, T. G., Conchon, M. F., Garcia, A. K. A., Pierotti, I., Serato, V. M., & Fonseca, L. F. (2019). Prevalence, intensity and discomfort of thirst in surgical patients in the immediate post-operative period. *Rev SOBECC*, *24*(2), 85-90. DOI: 10.5327/Z1414-4425201900020006

Oztas, M., & Oztas, B. (2022). Effect of spray use on mouth dryness and thirst of patients undergoing major abdominal surgery: A randomized controlled study. Journal of PeriAnesthesia Nursing, 37(2), 214-220. Retrieved from: https://doi.org/10.1016/j.jopan.2021.04.018

Pierotti, I., Fracarolli, I. F. L., Fonseca, L. F., & Aroni, P. (2018). Evaluation of the intensity and discomfort of perioperative thirst. *Escola Anna Nery*, *22*. Retrieved from https://doi.org/10.1590/2177-9465-EAN-2017-0375

Polit, D. F., & Beck, C. T. (2018). *Essentials of Nursing Research: Appraising evidence for nursing practice* (9th ed). Philadelphia: Wolters Kluwer. Retrieved from https://books.google.com.eg/books?hl=en&lr=&id=7GtP8VCw4BYC&oi=fnd&pg=PA258&dq=Polit,+D.F.,+%26+Beck,+C.T.+(2018).+Essentials+of+nursing+research:+Appraising+evidence+for+nursing+practice+(9th+ed+).+Philadelphia:+Wolters+Kluwer&ots

Puntillo, K., Arai, S. R., Cooper, B. A., Stotts, N. A., & Nelson, J. E. (2014). A randomized clinical trial of an intervention to relieve thirst and dry mouth in intensive care unit patients. *Intensive Care Medicine*, *40*, 1295-1302. DOI: 10.1007/s00134-014-3339-z. Epub 2014 Jun 4.

Puntillo, Kathleen A., Shoshana Arai, Neal H. Cohen, Michael A. Gropper, John Neuhaus,

Steven M. Paul, & Christine Miaskowski, (2010). "Symptoms experienced by intensive care unit patients at high risk of dying." *Critical Care Medicine 38,* (11), 2155. DOI: 10.1097/CCM.0b013e3181f267

Rahman, R., Gupta, S., & Manyonda, I. (2017). Hysterectomy for benign gynaecological disease. *Obstetrics, Gynaecology & Reproductive Medicine*, 27(4), 125-131. Retrieved from https://doi.org/10.1016/j.ogrm.2017.01.012

Sato, K., Tsuda, C., Odawara, S., Kushida, A., & Taniguchi, T. (2022). Effect of high-flow nasal cannula therapy on thirst sensation and dry mouth after extubating: A single-center prospective cohort study. *Intensive and Critical Care Nursing*, 74, 103339. Retrieved from https://doi.org/10.1016/j.iccn.2022.103339

Seada, A. I. A., Younis, G. A. E., & Eid, S. (2020). The effect of a frozen saline swab on thirst intensity and dry mouth among critically ill post-operative patients at Tanta university. *International Academic Journal of Health, Medicine and Nursing*, 1(2), 189-201. Retrieved from http://www.iajournals.org/articles/iajhmn_v1_i2_189_201.pdf

Sebaee, H. A. A., & Elhadary, S. M. (2017). Effectiveness of a care bundle on postoperative thirst relief and oral condition among patients undergoing abdominal surgeries. *IOS J Nurs Health Sci, 6* (5), 82-90. DOI: 10.9790/1959-0605048290

Serato, V. M., Fonseca, L. F., Birolim, M. M., Rossetto, E. G., Mai, L. D., & Garcia, A. K. A. (2019). Package of menthol measures for thirst relief: A randomized clinical study. *Revista Brasileira de Enfermagem, 72*, 600-608. Retrieved from https://doi.org/10.1590/0034-7167-2018-0057

Shikha, G., Vinay, K., & Neetu, K. (2020). Effectiveness of an intervention bundle on thirst intensity and dry mouth among patients admitted in intensive care units. *Indian Journal of Public Health Research & Development*, 11(4). Retrieved from https://www.researchgate.net/publication/344327185

Shimosato, M., Asai, K., Yokomichi, N., Nagano, K., & Sakane, N. (2021). Diagnostic accuracy of patient-reported dry mouth as a predictor for oral dryness in terminally ill cancer patients. *Supportive Care in Cancer, 29* (5), 2743-2748. DOI: 10.1007/s00520-020-05798-y

Sung, H., Ferlay, J., Siegel, R. L., Laversanne, M., Soerjomataram, I., Jemal, A., & Bray, F. (2021). Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: a cancer journal for clinicians*, 71(3), 209-249 .DOI: 10.3322/caac.21660

Tereza, D. M., Baldasso, G. M., Paes, R. S., Pacheco, M. E., Rosa, P. P., Vendramine, B., ... & Dutra, R. C. (2021). Evaluation of the protocol for thirst management using ice popsicles in the immediate postoperative period: A pilot study in southern Brazilian hospital. *Anais da Academia Brasileira de Ciências*, 93. Retrieved from https://doi.org/10.1590/0001-3765202120201260

Tsai, H. Y., Chao, A., & Hsiao, W. L. (2022). The effectiveness of cold oral stimuli in quenching postoperative thirst: A systematic review and meta-analysis. *Intensive and Critical Care Nursing*, 103359. Retrieved from https://doi.org/10.1016/j.iccn.2022.103359

Virgens, I. P. A. D., Carvalho, A. L. M. D., Nagashima, Y. G., Silva, F. M., & Fayh, A. P. T. (2020). Is perioperative fasting associated with complications, length of hospital stay and mortality among gastric and colorectal cancer patients? A cohort study. *Sao Paulo Medical Journal*, 138, 407-413. Retrieved from https://doi.org/10.1590/1516-3180.2020.0084.R1.30062020

VonStein, M., Buchko, B. L., Millen, C., Lampo, D., Bell, T., & Woods, A. B. (2019). Effect of a scheduled nurse intervention on thirst and dry mouth in intensive care patients. *American Journal of Critical Care*, 28(1), 41-46. Retrieved from https://doi.org/10.4037/ajcc2019400

Wang, J. J., Lei, K. F., & Han, F. J. E. R. M. P. S. (2018). Tumor microenvironment: Recent advances in various cancer treatments. *Eur Rev Med Pharmacol Sci*, 22(12), 3855-3864. DOI: 10.26355/eurrev_201806_15270.

Watson, F., & Austin, P. (2021). Physiology of human fluid balance. *Anaesthesia & Intensive Care Medicine, 22* (10), 644-651

Retrieved from https://doi.org/10.1016/j.mpaic.2021.07.010

Weimann, A., Braga, M., Carli, F., Higashiguchi, T., Hübner, M., Klek, S., ... & Singer, P. (2017). ESPEN guideline: Clinical nutrition in surgery. *Clinical nutrition*, *36*(3), 623-650. Watson, F., & Austin, P. (2021). Physiology of human fluid balance. Anaesthesia & Intensive Care Medicine, 22(10), 644-651 Retrieved from https://doi.org/10.1016/j.clnu.2017.02.013

World Health Organization (WHO). Global Health Estimates (2020): Deaths by cause, age, sex, by country and by region, 2000-2019. WHO; 2020. Accessed December 11, 2020. Retrieved from who.int/ data/gho/data/theme s/morta lity-andgloba l-healt h-estim ates/ghe-leadi ngcause s-of-death

Yamada, T., Hayashi, T., Cho, H., Yoshikawa, T., Taniguchi, H., Fukushima, R., & Tsuburaya, A. (2012). Usefulness of enhanced recovery after surgery protocol as compared with conventional perioperative care in gastric surgery. *Gastric cancer*, *15*, 34-41 DOI 10.1007/s10120-011-0057-

Yang, L. Y., Yates, P., Chin, C. C., & Kao, T. K. (2010). Effect of acupressure on thirst in hemodialysis patients. *Kidney and Blood Pressure Research*, *33*(4), 260-265. Retrieved from http://dx.doi.org/10.1159%2F000317933

Zhang, W., Gu, Q., Gu, Y., Zhao, Y., & Zhu, L. (2022). Symptom management to alleviate thirst and dry mouth in critically ill patients: A randomized controlled trial. *Australian Critical Care*, *35*(2), 123-129. Retrieved from https https://doi.org/10.1016/j.aucc.2021.04.002